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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/839,963	04/23/2001	Sangki Hong	CS99-210	4495

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EXAMINER
MALDONADO, JULIO J

ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 09/19/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/839,963	HONG ET AL.	
	Examiner	Art Unit	
	Julio J. Maldonado	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 April 2001* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *2* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-3 are rejected under 35 U.S.C. 102(b) as being anticipated by Liu et al. (U.S. 5,693,568).

Liu et al. (Figs.1-9) in a related method to form self-aligned anti-via interconnects teach the steps of providing a semiconductor substrate; depositing a metal layer (7, 8, 9) overlying said semiconductor substrate, wherein said metal comprises aluminum; etching through said metal layer (7, 8, 9) to form connective lines (10, 11, 12); partially etching through said connective lines (10, 11, 12) to form vias (40); depositing a dielectric layer (30) overlying said vias (40), said connective lines (10, 11, 12) and said semiconductor substrate; and polishing down said dielectric layer (30) to complete said self-aligned, anti-via interconnects in the manufacture of the integrated circuit device, wherein said semiconductor substrate comprises semiconductor devices (2, 3, 4, 6) in and on a silicon substrate (1) covered by an insulating layer (5) (column 6, line 54 – column 7, line 64).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 4-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. ('568) in view of Wang et al. (U.S. 6,080,660).

In reference to claims 4, 5, 7 and 8, Liu et al. teach forming an etch-stop layer (8) comprising titanium nitride (column 6, lines 56-62). Liu et al. fail to teach the steps of performing a partial etch process comprising a timed etch; using silicon oxide as a dielectric layer; and depositing an antireflective coating (ARC) layer comprising titanium nitride prior to etch through the metal layer. However, Wang et al. (Figs.2A-2C) in a related method to form interconnect structures teach the steps of performing a partial etch process comprising a timed etch on a metal layer (22); using silicon oxide as a dielectric layer (23); and depositing an antireflective coating (ARC) layer (24) comprising titanium nitride prior to etch through the metal layer (22) (column 3, line 55 – column 4, line 26). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to use titanium nitride as an ARC layer and silicon oxide as a dielectric layer as taught by Wang et al. in the anti-via formation method of Liu et al., since these materials are commonly used in the fabrication of metal interconnects (column 1, lines 34-63). It would also have been obvious to one of ordinary skill in the art at the time of the invention was made to perform a timed etch on the metal layer as taught by Wang et al. in the anti-via formation method of Liu et al., since timed etching process are used to control the degree of etching (column 4, lines 22-26).

In reference to claim 6, Liu et al. in combination with Wang et al. substantially teach all aspects of the invention but fail to show depositing a dielectric layer to a thickness of between about 5,000 angstroms and 20,000 angstroms. However, the selection of the claimed range is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious).

In reference to claims 9, 10, 13-19, 22 and 23, Liu et al. (Figs.1-9) in a related method to form self-aligned anti-via interconnects teach the steps of providing a semiconductor substrate; depositing a first metal layer (7) overlying said semiconductor substrate, wherein said metal layer (7) comprises aluminum; depositing an etch-stop layer (8) overlying said metal layer (7), wherein said etch-stop layer (8) comprises titanium nitride; depositing a second metal layer (9) overlying said first metal layer (7), wherein said metal layer (9) comprises aluminum; etching through said second metal layer (9), said etch stop layer (8), and said first metal layer (7) to form connective lines (10, 11, 12); etching through said second metal layer (9) to form vias (40), wherein said etch stop layer (8) acts as an etch stop; depositing a dielectric layer (30) overlying said vias (40), said connective lines (10, 11, 12) and said semiconductor substrate; and polishing down said dielectric layer (30) to complete said self-aligned, anti-via interconnects in the manufacture of the integrated circuit device, wherein said

semiconductor substrate comprises semiconductor devices (2, 3, 4, 6) in and on a silicon substrate (1) covered by an insulating layer (5) (column 6, line 54 – column 7, line 64).

Liu et al. fail to teach the steps of depositing an antireflective coating (ARC) layer comprising titanium nitride over the second metal layer; performing a timed etching process; and using silicon oxide as a dielectric layer. However, Wang et al. (Figs.2A-2C) in a related method to form interconnect structures teach the steps of depositing an antireflective coating (ARC) layer (24) comprising titanium nitride over a metal layer (22); performing a timed etching process; and using silicon oxide as a dielectric layer (23) (column 3, line 55 – column 4, line 26). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to use titanium nitride as an ARC layer and silicon oxide as a dielectric layer as taught by Wang et al. in the anti-via formation method of Liu et al., since these materials are commonly used in the fabrication of metal interconnects (column 1, lines 34-63). It would also have been obvious in the art at the time of the invention was made to perform a timed etch on the metal layer as taught by Wang et al. in the anti-via formation method of Liu et al., since timed etching process are used to control the degree of etching (column 4, lines 22-26).

In reference to claims 11, 12, 20 and 21, Liu et al. in combination with Wang et al. substantially teach all aspects of the invention but fail to show depositing a dielectric layer to a thickness of between about 5,000 angstroms and 20,000 angstroms and depositing a metal layer to a thickness of between about 3,000 angstroms and 10,000 angstroms. However, the selection of the claimed ranges is obvious because it is a

matter of determining optimum process condition by routine experimentation with a limited number of species. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious).

Conclusion

5. Papers related to this application may be submitted directly to Art Unit 2823 by facsimile transmission. Papers should be faxed to Art Unit 2823 via the Art Unit 2823 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2823 Fax Center number is **(703) 305-3432**. The Art Unit 2823 Fax Center is to be used only for papers related to Art Unit 2823 applications.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Julio J. Maldonado** at **(703) 306-0098** and between the hours of 8:00 AM to 4:00 PM (Eastern Standard Time) Monday through Friday or by e-mail via julio.maldonado@uspto.gov. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy, can be reached on (703) 308-4918.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 308-0956**.

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